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THE SYSTEM OF CASTOR.

(Abstract from L. O. Bulletin No. 98.)

Both components of this interesting visual double star are of the Sirian type of spectrum. The absorption is more complete in the fainter star (α_1 *Geminorum*, magn.=3.7) than in the brighter (α_2 *Geminorum*, magn.=2.7). As a result the lines are more distinct in α_1 and more lines can be measured. But the less distinct lines in α_2 admit of slightly more precise settings being made.

The fainter component was shown to be a spectroscopic binary, with a period of nearly three days, by Professor BELOPOLSKY, of Pulkova, in 1895. The binary character of the brighter member of the system was discovered by the writer in October, 1904, from plates taken with the Mills spectrograph. The definitive orbits of both systems have been computed. The number of plates used in the case of α_1 was thirty-two, and an average of thirty-four lines was measured on each plate. The elements derived for α_2 depend upon forty-eight plates. The average number of measurable lines for this component was twenty-four. The full details of the calculations are given in the original paper. The resulting definitive elements for the two systems are as follows:

	α_1 *Geminorum.* (Fainter Component)		α_2 *Geminorum.* (Brighter Component.)	
Period =	2.928285 days		9.218826 days	± 0.000108
T =	J.D. 2416828.057	± 0.042	J. D. 2416746.385	± 0.021
e =	0.01	± 0.0066	0.5033	± 0.0112
ω =	102°.516	± 5°.120	265°.353	± 1°.739
K =	31.76	± 0.220	13.56	± 0.22
V =	-0.98^{km}	$\pm 0.15^{km}$	$+6.20^{km}$	$\pm 0.17^{km}$
$a \sin i$ =	$1{,}279{,}000^{km}$		$1{,}485{,}000^{km}$	
$[pvv]$ =	37.6		29.0	

For α_1 *Geminorum* the eccentricity is shown to be much smaller than supposed by BELOPOLSKY. In particular, BELOPOLSKY'S assumption of any rotation in the line of apsides is shown to be without foundation. The maximum effect of such a rotation for elements with an eccentricity of 0.01 would be but —0.3km, an amount too small to detect with certainty, in stars of this spectral type.

With future determinations of the elements of the visual system it will eventually be possible to determine with considerable accuracy the parallax, masses, and orbital dimensions of this unique quadruple system. But the visual elements are absolutely indeterminate as yet, and assumptions as to the values of the parallax and other physical constants have no value.

It is not unreasonable to postulate, however, that the inclination of the orbital planes of both spectroscopic systems is roughly that of the main system. This is indeterminate at present. If we assume $i=63^\circ$ as given by DOBERCK[1] in the elements which he regards as most probable (period=347 years), then the values for the semi-major axes of the spectroscopic systems are:—

$$\alpha_1 \textit{ Geminorum}, a = 1{,}435{,}000^{km}$$
$$\alpha_2 \textit{ Geminorum}, a = 1{,}667{,}000^{km}$$

These values are mere hypotheses, but it seems quite probable that the orbital dimensions of both systems are of the same order of magnitude. We would have in this case the interesting combination of two spectroscopic systems of approximately the same linear dimensions, one of which has the very great eccentricity of 0.50, while the orbit of the other is nearly circular. By the commonly accepted theories of stellar evolution this would seem to indicate that the brighter pair is much the older of the two systems. It has already approximated to the eccentricity of the main system, while its fainter companion system, of three times greater mass, still revolves in orbits almost circular.

Such an eccentricity as shown in α_2 is rarely met with except in those spectroscopic binaries which have as well a variation in their light. The tidal action in such a system, where at periastron the stars are but one third of their apastron distance apart, must be enormous. The attempt was accordingly made to test the constancy of the light of the brighter star by a series of observations with the smaller of the two Bruce polarizing double-image photometers belonging to the Lick Observatory. The observations were made with the photometer attached to the twelve-inch equatorial. There is no evidence of any variation from the present series. If it exists at all, it must be very small, and would require a long series of observations to substantiate. There is no evidence, moreover, of any irregularity in the spectroscopic velocity curve.

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[1] A. N., Vol. 166, p. 145.

HEBER D. CURTIS.

COMET NOTES.

Seven new comets have been announced in the last five months: Comets *b, c, d,* and *e,* 1905, and *a, b,* and *c,* 1906. Three of these were discovered by photography and all were telescopic objects except GIACOBINI'S second comet (*c*) of the year 1905, which attained maximum brightness January 22, 1906, and would have been a fairly conspicuous naked-eye object but for its proximity to the Sun. The discovery of his first comet (*a*) of 1905 was followed by a lull of eight months in comet finding.

Comet *b* (SCHAER) was last seen and measured at this observatory by Mr. SMITH on December 29, 1905. Careful search with the 36-inch by Dr. AITKEN and the writer on January 5th, 20th, 26th, and 27th, under poor atmospheric conditions, failed to reveal the comet with certainty, though on the last date a suspected object was glimpsed in the predicted place.

Comet *c* 1905 (GIACOBINI) is still measurable, but is low in the western sky at sunset and difficult under the persistently bad weather conditions. The last measure secured here was on the evening of March 15th.

Comets *d* and *e* 1905 were discovered on the same photographic plate at Lowell Observatory two and four weeks respectively after the exposure. No search was made here, in the absence of sufficient search data.

Comet *a* 1906 (BROOKS) is still measurable, and is closely following the second orbit computed for it at the Students' Observatory.

Telegraphic announcement of the discovery of Comet *b* 1906 by KOPFF at Heidelberg was received March 5th. The comet was found in the photographic search for asteroids. Fortunately the weather permitted measures here on the 5th, 6th, and 7th. The comet's apparent motion is very small, as it is nearly in opposition and moving nearly parallel to the Earth's orbit (at an inclination of 1°). A fourth measure